

We claim:

1. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space, comprising:

a plurality of separable support frame plates collectively configured to circumscribe said

5 opening between one floor or space and another floor or space; and

a plurality of connection sites disposed at opposing ends of each of the plurality of separable support frame plates to facilitate connection of each support frame plate to support frame plates adjacent the opposing ends thereof, said connection sites comprising at least one of mating locking connectors and a plurality of matching through-holes to permit insertion of a
10 fastening means therethrough.

2. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 1, wherein said plurality of support frame plates comprises a head plate, a right side plate, a left side plate, and a
15 foot plate, and wherein said head plate is configured with at least one hinge slot to receive a folded ladder.

3. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 2, wherein at least
20 one of said left frame plate and said right frame plate is bent inwardly at a top and a bottom surface thereof to form substantially U-shaped portions defining gap between inner edges of the bent portions and the remainder of the frame plate to correspondingly define at least one track.

4. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 3, wherein at least one of the opposing ends of at least one of said head plate and said foot plate are configured for insertion within said track.

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5. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 3, further comprising a rack plate disposed within said at least one track.

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6. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 3, wherein said left frame plate and said right frame plate are bent inwardly at a top and a bottom surface thereof to form substantially U-shaped portions defining gap between inner edges of the bent portions and the remainder of the frame plate to correspondingly define a track in each of the left frame plate and right frame plate, and wherein a rack plate is disposed within each of the tracks.

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7. A support frame for a foldable ladder configured for installation in an opening between one floor or space and another floor or space in accord with claim 6, wherein said left frame plate and said right frame plate comprise a plurality of tabs and adjacent openings distributed along and displaced from a centerline a respective one of the left frame plate and right frame plate, and wherein each of said openings is disposed adjacent a respective one of said tabs on a side of the tab closest to said head plate.

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8. A strut positioning system for a foldable ladder configured for installation in an opening defined between one floor or space and another floor or space, the opening having a distal side to which a ladder is rotatably attached, a proximal side to which an opening or closing torque is applied to open or close the foldable ladder, and a first and a second lateral side, the gas

5 strut positioning system comprising:

at least one strut having a proximal end and a distal end;

a track configured for mounting in a fixed position relative to and along one of said first lateral side and said second lateral side of said opening defined between one floor or space and another floor or space;

10 a rack plate comprising gear teeth configured to matingly engage corresponding pinion gear teeth and comprising a connector for connecting to said proximal end of said strut, said rack plate being configured for translational movement within said track from a first position to a second position, wherein the first position corresponds to a non-compressed state of said strut and said second position corresponds to a compressed state of said strut;

15 a locking device configured to lock said rack plate in said second position;

a pinion gear comprising teeth configured to matingly engage corresponding rack plate gear teeth and comprising a torque application member configured to matingly engage a torque application tool, said pinion gear being rotatably mounted in a fixed position on said lateral side of said opening within said track;

20 wherein, upon connection of said distal end of said strut to one of a ladder and a link member attached to a ladder and compression of said strut by application of a torque to said pinion gear, said rack plate is locked in said second position.

9. A strut positioning system in accord with claim 8, wherein said track comprises at least one landing positioned between said first position and said second position, said landing configured to prevent reverse translation of said rack plate in a direction toward said first position past said landing under a bias of said strut, and wherein said strut comprises at least one
5 of a gas strut, a hydraulic strut, and a spring strut.

10. A strut positioning system in accord with claim 9, wherein said landing comprises a tab and wherein said rack plate comprises a stop member adapted to permit, in combination with said tab, movement of said rack plate over said tab only in a direction from the first position
10 toward the second position.

11. A strut positioning system in accord with claim 10, wherein said stop member comprises a ratchet resiliently mounted on said rack plate.

15 12. A strut positioning system in accord with claim 11, wherein said stop member ratchet is resiliently mounted on said rack plate by a spring plate.

13. A strut positioning system in accord with claim 11, wherein said landing comprises an opening disposed on a side of the tab closer to the second position than the first
20 position, and wherein said ratchet is configured to engage both said tab and said opening.

14. A strut positioning system in accord with claim 8, wherein said track, said rack plate, said locking device, said pinion gear, and said strut are provided along another one of said first lateral side and said second lateral side.

5 15. A strut positioning system for a foldable ladder configured for installation in an opening defined between one floor or space and another floor or space, the opening having a distal side to which a ladder is rotatably attached, a proximal side to which an opening or closing torque is applied to open or close the foldable ladder, and a first and a second lateral side, the gas strut positioning system comprising:

10 at least one strut having a proximal end and a distal end;

a track configured for mounting in a fixed position relative to and along one of said first lateral side and said second lateral side of said opening defined between one floor or space and another floor or space;

15 a slide plate configured for translational movement within said track from a first position to a second position, wherein the first position corresponds to a non-compressed state of said strut and said second position corresponds to a compressed state of said strut;

a locking member for locking said slide plate in said second position;

20 wherein, upon connection of said distal end of said strut to one of a ladder and a link member attached to a ladder and compression of said strut, said slide plate is locked in said second position by said locking member.

16. A strut positioning system in accord with claim 15, wherein said track comprises a plurality of landings disposed between said first position and said second position, said

landings configured to prevent reverse translation of said slide plate in a direction toward said first position past said landing under a bias of said strut, said strut comprising at least one of a gas strut, a hydraulic strut, and a spring strut.

5 17. A strut positioning system in accord with claim 16, wherein each of said track
landings comprises a tooth having a rearwardly slanted front face and one of a perpendicular or a
forwardly slanted rear face, and wherein said slide plate comprises a ratchet tooth having at a
front face having one of a perpendicular or a forwardly slanted face correspondingly
complementing a shape of a rear face of said track landing tooth and having a forwardly slanted
10 rear face having a shape substantially correspondingly complementing a shape of the track
landing tooth front face, wherein said slide plate tooth is biased into engagement with said track
landing tooth to thereby permit motion of the slide plate in only one direction.

18. A strut positioning system in accord with claim 17, wherein the plurality of track
15 landings are substantially contiguous and comprise, in combination, a linear pawl.

19. A strut positioning system in accord with claim 18, wherein a track is provided on
each of said first and second lateral sides, wherein a linear pawl is provided along a top and a
bottom of said tracks, and wherein said slide plate comprises an outwardly biased ratchet tooth
20 extending from a top and a bottom side thereof.

20. A strut positioning system in accord with claim 19, wherein said means for locking said rack plate in said second position comprises one of a mechanical fastener and said ratchet tooth and linear pawl.

5 21. A method for installing a foldable ladder configured for installation in an opening defined between one floor or space and another floor or space, the method comprising:

defining an opening having a distal side to which a ladder is rotatably attached, a proximal side to which an opening or closing torque is applied to open or close the foldable ladder, and a first and a second lateral side;

10 installing a strut positioning system within a perimeter of said opening, said strut positioning system comprising a track configured for mounting in a fixed position relative to and along one of said first lateral side and said second lateral side of said opening defined between one floor or space and another floor or space; a rack plate comprising gear teeth configured to matingly engage corresponding pinion gear teeth and comprising a connector for connecting to
15 an end of a strut, said rack plate being configured for translational movement within said track from a first position to a second position, wherein the first position corresponds to a non-compressed state of said strut and said second position corresponds to a compressed state of said strut; a locking device configured to lock said rack plate in said second position; and a pinion gear comprising teeth configured to matingly engage corresponding rack plate gear teeth and
20 comprising a torque application member configured to matingly engage a torque application tool, said pinion gear being rotatably mounted in a fixed position on said lateral side of said opening within said track;

positioning a folded ladder assembly at least partially within said opening and securing said folded ladder assembly relative to said opening;

pivoting said folded ladder assembly forwardly until the folded ladder is sufficiently close to the support frame to permit attachment of curved brackets connecting upper lateral ends of said folded ladder to connectors provided on said first and second lateral sides of said opening

attaching one end of a strut, comprising at least one of a gas strut and a hydraulic strut, to one of said folded ladder and an extension member attached to said folded ladder and attaching another end of said strut to said rack plate connector when said rack plate is positioned at said first position, wherein said strut is in a non-compressed state;

applying a torque to said pinion gear to correspondingly move said rack plate along said track from said first position to said second position and to thereby compress said strut; and securing said rack plate at said second position.

22. A method for installing a foldable ladder configured for installation in an opening defined between one floor or space and another floor or space, the method comprising:

defining an opening having a distal side to which a ladder is rotatably attached, a proximal side to which an opening or closing torque is applied to open or close the foldable ladder, and a first and a second lateral side;

assembling a support frame assembly;

installing said support frame assembly along an inner perimeter of said opening;

installing a strut positioning system along at least lateral side of said support frame assembly, said strut positioning system comprising a track configured for mounting in a fixed position relative to and along one of said first lateral side and said second lateral side of said

opening defined between one floor or space and another floor or space; a rack plate comprising gear teeth configured to matingly engage corresponding pinion gear teeth and comprising a connector for connecting to an end of a strut, said rack plate being configured for translational movement within said track from a first position to a second position, wherein the first position
5 corresponds to a non-compressed state of said strut and said second position corresponds to a compressed state of said strut; a locking device configured to lock said rack plate in said second position; and a pinion gear comprising teeth configured to matingly engage corresponding rack plate gear teeth and comprising a torque application member configured to matingly engage a torque application tool, said pinion gear being rotatably mounted in a fixed position on said
10 lateral side of said opening within said track;

positioning a folded ladder assembly at least partially within said opening and securing said folded ladder assembly to said support frame assembly;

pivoting said folded ladder assembly forwardly until the folded ladder is sufficiently close to the support frame to permit attachment of curved brackets connecting upper lateral ends
15 of said folded ladder to connectors provided on lateral sides of said support frame;

attaching one end of a strut, comprising at least one of a gas strut and a hydraulic strut, to one of said folded ladder and an extension member attached to said folded ladder and attaching another end of said strut to said rack plate connector when said rack plate is positioned at said first position, wherein said strut is in a non-compressed state;

20 applying a torque to said pinion gear to corresponding move said rack plate along said track from said first position to said second position and to thereby compress said strut; and securing said rack plate at said second position.

23. A method for installing a foldable ladder configured for installation in an opening defined between one floor or space and another floor or space, the method comprising:

defining an opening having a distal side to which a ladder is rotatably attached, a proximal side to which an opening or closing torque is applied to open or close the foldable ladder, and a first and a second lateral side;

installing a strut positioning system along at least lateral side of said support frame assembly, said strut positioning system comprising a track configured for mounting in a fixed position relative to and along one of said first lateral side and said second lateral side of said opening; a slide plate configured for translational movement within said track from a first position to a second position,

positioning a folded ladder assembly at least partially within said opening and securing said folded ladder assembly relative to said opening;

attaching curved brackets connecting upper lateral ends of said folded ladder to connectors provided at said first and second lateral sides of said opening;

attaching one end of a strut, comprising at least one of a gas strut and a hydraulic strut, to one of said folded ladder and an extension member attached to said folded ladder and attaching another end of said strut to said slide plate when said rack plate is positioned at said first position, wherein said strut is in a non-compressed state;

moving said slide plate from said first position toward said second position along said track to compress said strut; and

securing said rack plate at said second position.